# TROPICAL AGRICULTURE

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## LORD MILNER'S APPEAL.

THIS number of "Tropical Agriculture" appears from the press while the appeal recently issued under the aegis of Lord Milner, for funds for the Imperial College of Tropical Agriculture is still before the public. It may be of interest, therefore, to lay before readers of "Tropical Agriculture" a brief statement of the aims of the College and the lines of development which a favourable response to that appeal will render possible. The appeal is Imperial and is addressed to all who have the Empire at heart; the College, if it is to reflect the character of the appeal, must be Imperial also. It is time, however, to leave aside generalities and to get down to facts if such funds as may result from the appeal are to be well spent. These hard facts are brought into immediate prominence when an attempt is made to answer the question, what are the conditions prevalent in the tropical parts of the Empire which must be reflected in the development of the College if it is to play an important role within the Empire?

Regarded in broad outline, the tropical portions of the Empire are seen to be divisible into two sections. The distinctive feature is essentially one of climate. It is the difference between a continental and an island, or coastal, climate.

In the former the rainy season alternates with an intensely dry and arid period, in the latter the climate is evenly moist, possibly with a "dry" period or periods, but with these of such a duration that plant growth is not materially checked. It is a distinction which breaks down only in the Tropical Equatorial belt of Central Africa which lies, however, largely outside the Empire. This difference is capable of being stated in other forms according to the point of view but fundamentally it is climatic. Thus it is the difference which exists between The Field and The Garden as these are generally visualised. Put in another way, it is the difference between the cultivation of annuals and perennials. Again, and arising out of this, it is the difference between capitalistic and non-capitalistic development or, in other words, between delayed or early return.

Among the Island and Coastal areas, Ceylon and other Islands of the Eastern Tropical Seas produce tea, rubber, and coconut; the Gold Coast cacao and oil-palms; the West Indies, cacao and sugar. Of these sugar alone gives an annual return but is a capitalist's crop in as far as a complex manufacturing process must accompany cultivation and demands large supplies of the raw cane. On the other side India produces cotton, sesamum, maize, fibres and a vast number of such products; it produces also cane, but for the most part on a non-capitalistic basis with the omission of the factory. Central Africa produces cotton and sesamum but it also produces coffee; South Africa, maize and millets but here again oranges. Throughout Africa, too, a large cattle industry is established which is adapted to either capitalistic or non-capitalistic development. In both cases, though exceptions occur, the major and characteristic features will be found to be as stated.

Development, then, is likely to proceed on very distinct lines, in the two cases the economics problems connected with which are very different. On the one hand the perennial crop implies money locked up for a long period without return and is a crop quite unsuited to the small cultivator. Its cultivation implies substantial landholders employing paid labour in the "Plantation" or "Garden." The annual crop on the other hand, locks up but little capital in actual production and is essentially adapted to the small cultivator. For reasons purely external to the crop, some organisation of the small cultivators is desirable to ensure attention to such matters as uniformity of produce, mutual

protection against pests and economic marketing. Though co-operation affords one method of such organisation there can be little doubt that the soundest and most economic means of ensuring the co-ordination required is the substantial landholder working land through tenants as an "Estate." That is the economic aspect but when further it is remembered that large sections of the continental tracts of the Empire bear an indigenous population with very defined and *prescriptive* rights in the land, economics ceases to be the decisive factor and the expediency of "Estate development" changes to a necessity.

The interesting questions here raised as to the exact meaning of the term "Estate development" and as to the correct relation between landlord and tenant cannot now be dealt with, but anyone who has been brought face to face with them, whether as administrator, financier, agricultural officer, planter, or as missionary will recognise their importance. The essential fact is that within the Empire exist tracts which must be developed on an "Estate" basis and which, in area, certainly exceed the areas adapted to a "Plantation" system. This is a fact which the College must recognise if it is to be in the full sense Imperial. Its curriculum must include and deal adequately with the economics of tenancy as well as that of cultivation by paid labour and this necessary practical demonstration can only be supplied on an area of sufficient size to illustrate the working of "Estate Management" in its fullest sense, including, that is, tenancy, centralised marketing and such like. At an institution so equipped only can a young man get that adequate insight into tropical development which will enable him to "make good" in each and every part of the tropical portions of the Empire. Such an Estate the College does not yet possess and its provision will form one of the first claims against such funds as result from the appeal.

It may be doubted whether Trinidad, situated as it is with typical island conditions, is best suited to meet the requirements of a College destined to meet such diverse needs; it may even be doubted whether any one locality will meet such requirements satisfactorily. Fortunately, as has been said, the two systems are not mutually exclusive and are to be found running side by side. Fortunately there is found in Trinidad a system of cane farming which approximates to the "Estate" system as defined above and there is no reason to doubt that an adequate area can be developed as a sound commercial proposition on this basis. With a factory already in existence prepared to work up its canes such an Estate will supply the keystone to the structure centred in the Agricultural College and it is profoundly to be hoped that the response to the appeal will enable the structure to be completed. Unlike so many requirements the needs are, in this case, to meet a capital charge without subsequent liability, for such an estate should and must be, self-supporting.

H. MARTIN LEAKE.

## COLONIZATION AND TROPICAL CLIMATE.

In his presidential address to the geography section of the British Association at Toronto on August 7, 1924, Professor J. W. Gregory, F.R.S., dealt at length with the various circumstances that have led to the belief that tropical climates are unfavourable to white races. As a result of a critical examination of the evidence, Professor Gregory arrives at the conclusion that the white man is *not* physiologically disqualified, even from manual labour in the tropics. This opinion from so eminent an authority is of such great importance in connection with the development of tropical agriculture that a review of the main arguments put forward by Professor Gregory should not be out of place in this Journal. For fuller details, the reader is referred to "Nature" August 30, from which the following summary is culled.

The general distribution of mankind is in such close agreement with the rule that the white race has settled in temperate regions, and has left the tropics to the coloured races, that any policy inconsistent with that arrangement must be prepared to encounter a strong prepossession to the contrary. The rule is inconsistent with so many facts that it is not, however, a safe basis for national policy. For example, in America the whole continent, except for the Eskimo in the north, was once occupied by dark-coloured Mongolian tribes (the North American Indians), in which the colour of the skin, notwithstanding the enormous difference of the climate under which many members of the group exist, varies but little. The most northerly part of Europe is occupied by a coloured race, the Lapps. In Africa, the darkness of the skin does not always vary in accordance with distance from the equator.

There are four main factors that underlie the belief that the tropics are unsuitable for the white man. They are (*a*) heat (*b*) moist heat, (*c*) monotony in temperature and (*d*) actinic rays. Added to these are a certain number of miscellaneous factors (*e*) that will briefly be considered later.

(*a*) *Heat.*—Intense heat is usually regarded as injurious to people not protected by a dark skin. This view overlooks the automatic process by which the living human body adjusts itself to temperatures even higher than occur in any climate on earth. That heat is not the dangerous factor in the tropics, is evident from the fact that the hottest areas are often the healthiest. Agra is hotter and healthier than Bombay; the summer heat of Colorado is greater than that in the less healthy Mississippi Valley.

(*b*) *Moist heat.*—At any temperature above blood heat, the body is cooled only by evaporation of perspiration, which, however, does not take place in air saturated with moisture. Saturated air above blood heat is fatal to all men, white or black; but no earthly climate presents such a condition. It has, nevertheless, been suggested

that the limit of human activity is a moist heat at a temperature of 73°F., but there are well authenticated records of miners working four hour spells for months in Hong Kong, Straits Settlements, Borneo and in Ocean Island in the Pacific. At these places both white and coloured men survive the conditions. Hence the limit has been raised to 85°F. Yet Dr. Griffith Taylor found the highest wet-bulb temperature in North Australia to approach even this limit (*i.e.* 81° at Port Darwin), and the conditions there are probably no worse than they are in Calcutta, which is one of the healthiest cities in India, and has a large and vigorous European population. Moist heat, of course, is very trying, and must be considered in judging climates from the standard of comfort and personal efficiency. Nevertheless there seems to be no reason why black men should be able to withstand a higher moist-heat temperature than white men. On the contrary, Sir John Haldane believes that white men can usually stand more heat than black men, and cites the example of Clyde stokers who bear the heat of the Red Sea better than Lascars.

(*c*) *Monotony in temperature.*—Excessive monotony in the weather is no doubt depressing, and temperature changes have a stimulating beneficial effect. Still, extremes of cold and heat are much more inconvenient, so that the equability of oceanic climates is recognised as favourable for many conditions of health. The areas over which extreme uniformity of temperature prevails are so restricted, however, that this factor does not affect the problem of tropical settlement as a whole.

(*d*) *Actinic rays.*—Great importance was once attached to the pernicious influence of the ultra-violet chemical rays of the sun on persons not protected by a dark skin. This view reached its extreme expression in the writings of Surgeon-Major Woodruff, in 1905, who held that actinic rays of the sun are so inimical to the white man that they inhibit his permanent settlement within 45° of the Equator. Woodruff's conclusions have been generally discounted, and are refuted by the modern system of heliotherapy now so widely recommended by curative specialists. Any deleterious effects of the chemical rays of the sun may be avoided by the use of appropriate clothes, and physical conditions suggest that a black skin should afford less protection than a white skin. Indeed any injury that might be wrought by powerful sunshine is due, according to the work of Aron in the Philippines, to the heat rays at the red end of the solar spectrum, rather than to ultraviolet light.

(*e*) *Miscellaneous factors.*—The four previously considered factors may readily be tested and measured. Since they have failed to provide any basis for the unsuitability of the tropics for the white man, the appeal has been shifted to a complex of tropical influences, including a rise of body temperature; lessened activity of lung and kidney, and nervous disturbances. The rise of body temperature is emphatically denied by records; the asserted ill-effects of the tropics on respiration appear to have no foundation in fact; and Dr. A. B. Balfour has declared that there is less kidney troubles in the tropics than in temperate climates. The remaining charges against tropical climate are insignificant, or are not based on climatic elements at all. Thus, nervous troubles fall mainly on women, who have the strain of disciplining native servants into conformity with their own ways.

The trend of medical opinion to the view that there is no physiological reason why the white race should not inhabit the tropics may lead to a change similar to that regarding some localities in temperate regions that were once regarded as death traps and are now popular health resorts. Thus Algeria at the present day is a trusted sanatorium, whereas disease annually swept away 7 per cent. of the French Army that conquered it.

Under American administration, Havana has become one of the healthiest cities of the world. St. Lucia does not kill because of its climate, wrote Sir John Moore, the Governor in 1796, but because of mis-management. It is now one of the healthiest of our West Indian possessions. The French attempt to build the Panama Canal was defeated by disease, yet Surgeon-General Gorgas by discovering its nature, secured for the 10,000 people employed in its construction, as good health as they would have enjoyed in the United States. Gorgas claimed that the results in Panama "will be generally received as a demonstration that the white man can live and thrive in the tropics," and predicted that "as the amount of wealth which can be produced in the tropics for a given amount of labour is so much larger than that which can be produced in the temperate zone by the same amount of labour, the attraction for the white man to emigrate to the tropics will be very great when it is appreciated that he can be made safe as to health conditions at small expense. When the great valleys of the Amazon and of the Congo are occupied by a white population, more food will be produced in these regions than is now produced in all the rest of the inhabited world."

Most tropical white residents will testify to the soundness of the conclusions reached by the authorities on whose opinions Professor Gregory has based his important generalizations. Provided the health conditions of tropical regions can be made suitable by strict control of factors that favour the spread of infectious diseases, and that ample consideration be given to matters of diet and continence in living, there would appear to be no serious reason why a large part of the vast undeveloped tropics should not eventually provide an additional outlet and spacious home for the European races.

F. H.

## RESEARCH IN RELATION TO COTTON CULTIVATION.

[*This article is taken from the "Experiment Station Record" (Vol. 50 No. 8) and is presented to illustrate the enormous efforts which are being made to improve and extend the cultivation of cotton by research work, such as is carried on at the "Imperial College of Tropical Agriculture."*]

The increasing disposition to look to organised experimentation for the solution of many of the world's agricultural problems becomes more and more readily demonstrated. It is a result in part of the many tangible successes which have been attained by agricultural research institutions in their comparatively short history, and it is a recognition of their important function in the national economy. It indicates the deepening realization that expenditures for research purposes are in the nature of permanent investments, and moreover investments of a character wherein the returns from one discovery may be so large as to far more than compensate for even a considerable number of unproductive ventures.

As a conspicuous example of large-scale operations centering around a single commodity, there may be cited the efforts under way in the British Empire to promote cotton production and the increasing reliance being put upon research as a factor in that program. The importance of such an undertaking from the standpoint of the British Empire is readily appreciated. As was stated by Viscount Milner some time ago, "Our manufacturing industries at home are in constant need of raw materials. This is peculiarly the case with cotton ; indeed the world is threatened with a great shortage of this staple, and in many other industries the amount of raw material required is increasing day by day. The demand is great, not only in our country but on the part of our allies, and our late enemies as well. They all look to the British Empire to supply them, and it is obviously of the first importance that we should meet their demand to the utmost of our power . . . But when dwelling upon the great potentialities of the Empire in this respect, we must always bear in mind that a vigorous policy of development is necessary if we are to realise them."

Since 1900, the world's consumption of cotton has been increasing at a faster rate than production, because of the enlarged demands of manufactures in the United States, Canada, Japan, and India and reduced acre yields in the United States and Egypt. The decrease in Egypt, formerly considered a part of the British Empire, is ascribed to reduced soil fertility, poor drainage, inadequate fertilizing, the pink bollworm and other insect pests, use of an earlier but less productive variety, and agrarian disturbances. The main causes for the decline in the United States during the last decade have been the spread of the boll weevil and labour shortage. The most serious feature of the United States supply has been held to be the tendency to violent fluctuations, caused by reactions of prices on the area planted, weather damage during prolonged picking periods, and the speculative nature of the crop. Diversification has made restriction of the cotton area economically feasible, while high labour costs render cotton growing unattractive or even impossible at pre-war prices. Conditions such as prolonged picking periods, poor baling and compressing, and insect pests have tended to depreciate uniformity and quality, so important to the spinners of England.

The gradually reduced production in the regions long reputed as dependable commercial cotton growing areas has caused much active interest to be taken, especially by the British, in developing new cotton-growing districts in different parts of the world. Extension of the cotton industry into new regions of the Empire has been difficult. Among the important factors to be considered are climate, labour, transportation and finance, and the expansion of the industry calls for intensive study of the human elements and economic conditions involved, as well as the agricultural and environmental factors.

These conditions have been becoming more and more generally recognized, but their economic aspect has perhaps been most acutely realized in England, where an adequate supply of raw cotton has for generations been regarded as scarcely less essential in the economic structure than a sufficiency of food. The policy of developing a cotton supply grown within the Empire itself has been steadily gaining in favour, and as early as 1902 the British Cotton-Growing Association was formed at Manchester at the instance of Lancashire Chambers of Commerce and West African merchants at Liverpool for this specific purpose. The association was granted a Royal Charter in 1904, and includes in its membership spinners, manufacturers, merchants, shippers, and representatives of the different industries and labour bodies connected with the cotton trade.

Financial assistance has been given the association by a number of local governments on the condition that the association spend an equal amount in cotton growing and experimental work. Grants from the Imperial Treasury have been conditioned on spending the money in special districts approved by the Government, which recognized the value of the project, especially in developing the resources of the colonies. Some of the islands of the West Indies, dependent at one time on imperial grants for financial support, became very prosperous following the efforts of the association. Where several years ago grants of between £600,000 to £700,000 were made from the Imperial Treasury for the colonies and protectorates of Nigeria, Uganda, Nyasaland and the West Indies, in 1921 these grants were practically if not wholly cancelled, chiefly because of increased revenues due to cotton growing.

The principal empire cotton fields are : India, the Sudan, Nigeria, Uganda, Nyasaland and the

West Indies. In all of these the work has now passed the preliminary stage, and the association's activities now consist in developing these countries.

Several years ago it was felt that much greater efforts were needed to make more rapid progress with cotton growing in various parts of the Empire if the country was to obtain any large returns. As a result of appeals to the Prime Minister, the Empire Cotton Growing Committee, representing both Government departments and the cotton trade, was appointed in 1917 under the chairmanship of Sir Henry Birchenough to investigate the best means of developing the growing of cotton within the Empire and to advise the Government as to the necessary measures to be taken for this purpose. The report of this committee, rendered in October, 1919, after nearly three years of investigations, gave detailed information on cotton production within the Empire and on the needs of the industry and the serious nature of some potential dangers. Among its recommendations were those looking to the enlargement and strengthening of the agricultural departments in British colonies and dependencies and the establishment of a central research institute and of a bureau of information on cotton growing. In order to increase the supply and improve the training of scientific men capable of studying cotton, the committee advised the creation at British Universities of readerships in plant physiology, plant genetics, mycology, and entomology, and also the institution of research studentships to be held by graduates. It was also suggested that the British Cotton-Growing Association act without profit or loss as the agent of the Committee for marketing crops where this was agreeable to the local government.

To establish a permanent body to carry out these recommendations the Empire Cotton-Growing Corporation was formed under Royal Charter granted in November, 1921. It includes representatives of the Governments of England, India, South Africa, and Australia, of the cotton industry at home and in India, of Chambers of Commerce, of the British Cotton-Growing Association, and of other bodies interested in cotton growing on either the scientific or commercial side. The corporation may be described as analogous to an information and spending department, without Treasury control but under the direction of its own finance committee. It has an assured income devised partly from a capital contribution of nearly £1,000,000 made by the Government, and partly from a compulsory levy of 6*d.* per standard bale on all raw cotton purchased by spinners in England.

Special reports have been made by this body on the possibility of developing cotton production in Nigeria, Tanganyika, Nyasaland, Western Australia, and Queensland. Students have been trained in increasing numbers, and assistance of a practical nature has been given the Sudan Government, which is engaged in the development of an irrigation project.

An interesting event recently chronicled in *Nature* was the return of Sir John Russell, director of the Rothamsted Experimental Station, from a mission to the Sudan, in which he was associated with Dr. H. Martin Leake, Director of Agriculture for the United Provinces of India, in advising the Sudan Government as to the organization and direction of agricultural research to be undertaken in connection with irrigation projects in the Gezira plain south of Khartum. In view of the enormous possibilities for growing cotton in this region, the research work will be mainly concerned with this crop. The first instalment of this great project is expected to come into operation in the fall of 1925, when 300,000 acres will be put under irrigation, of which one-third will be in cotton. The complete project is estimated to be capable of development over an area of 3,000,000 acres and may ultimately produce 1,000,000 bales of cotton a year. It is anticipated that the Empire Cotton-Growing Corporation will co-operate with the Sudan Government in the research work projected, and that this work can be co-ordinated with a general plan for research work on cotton problems to be organized throughout the British Empire.

Another phase of co-operation in the industry is in the matter of scholarships. The Empire Cotton-Growing Corporation has recently made grants of £1,000 to each of five institutions for five years, to be used for the development of research likely to be of importance in relation to problems connected with cotton growing. One of these institutions is Rothamsted, where the funds are to be used in increasing the staff and equipment of the soil physics department and for special studies of water relationships in districts where cotton is grown. Another is the University of Manchester, where the grant will be used to promote research in mycology and entomology, particularly as to fungus diseases of plants likely to be of importance in cotton growing. Likewise, the corporation is sending four post-graduate students to the Imperial College of Tropical Agriculture for special research work in genetics and plant breeding, while the Indian Central Cotton Committee is financing six scholarships for qualified graduates of Indian Universities to enable them to prepare for research work under the direction of experienced investigators.

The Imperial Institute, located in London, has since its reorganization as a Government Institution in 1903 as a centre and clearing house for information and investigation for the commercial development of the natural resources of the Empire, continuously promoted the interests of British cotton cultivation as one of its major activities. This has been done mainly by conducting investigations respecting the quality of cotton grown in co-operation with the agricultural departments of the countries concerned and with the British Cotton-Growing Association, by collecting and publishing information respecting the progress of cotton growing in all countries,

and by arranging and maintaining reference collections of cottons from every country of the Empire. Numerous reports have been made to the local governments to planters and others respecting the quality and commercial value of cotton grown, the soil and its fertilizer needs, the types of cotton most likely to be suitable for trial in particular countries, the supply of seed and methods of seed disinfection, and the treatment required for insect pests and plant diseases. Much information has also been supplied concerning the methods of improvement of varieties of cotton by seed selection, by breeding, &c. Information has been systematically collected and arranged from publications respecting cotton cultivation in every part of the world, and also considerable data obtained by special application to governments and planting companies. Besides publishing a number of special reports and papers on cotton production, the institute has presented in its quarterly bulletin a comprehensive list of special articles on cotton and cotton production throughout the world.

The investigational work has chiefly consisted in examining samples of experimentally grown cotton, mainly as to length and strength of fibres and its suitability for special purposes in comparison with other cottons or with the same type of cotton grown in other countries. This work has been carried out in collaboration with the local agricultural departments, whose efforts have been directed to secure the type of cotton best adapted to the particular country and its improvement by various means. Numerous analyses of cotton soils have been conducted before and after experimental manurial treatment. The commercial value of various experimentally grown cottons has also been determined by reference to manufacturers as well as to brokers, and this section of the work has been carried on in close co-operation with the British Cotton-Growing Association.

The field of cotton technology has also been given special attention by the British Cotton Industry Research Association, incorporated in 1919. The council of this association is composed of representatives of all sections of the cotton industry, of trade associations, and of science. The need of an institution where all the sciences involved would be represented and could work in close co-operation was soon realised, and research laboratories at Shirley Institute, Manchester, were formally opened in 1922.

A broad view regarding the scope of the projected research has been taken by the council, and, as indicated by the program of research formulated by the research committee for the general guidance of the director and research staff, the work provided for is of a fundamental nature. Investigations in progress concern the life history and properties of the cotton fibre and research into the chemical and physical changes introduced during manufacture. These studies are deemed essential as a guide to the users of the fibre in conjunction with the investigators in suggesting improvements in present processes and machinery.

The study of the botanical, chemical, and physical properties of the single cotton fibre is fundamental to the entire industry. The botanical aspect is also concerned with the conditions of growth and breeding of the cotton plant, as far as these affect the quality of the raw material. Projects recently reported on concern the structure of the cotton fibre and its botanical aspects; the rigidity, clinging power, and convolutions of the cotton fibre; the measurable characters of raw cotton, including determination of area of cross section, fibre weight per centimetre, cell diameter, and breaking load of single fibres; mechanical testing of cotton materials; and the inheritance of characters in the plant. Some of the work is a continuation of the elaborate studies begun by Balls in Egypt.

The general purpose of the technological research in cotton spinning as now being conducted in England is to achieve a better understanding of cotton as a raw material and of what happens when it is spun. The sizing problem is also considered important, and other major problems which may be mentioned include the effect on the fibre of water and of steam at different pressures and the tendering of fibres and fabrics by acids, light and heat.

Confronted with these problems, the association has felt the need of a vast amount of purely scientific work of a type such as in the past has been restricted almost wholly to the universities. This work the association expects these institutions will continue and it also looks to them for the training of skilled research workers, hoping that the ties between the scientific workers and industry may become closer in the future. The director of research, A. W. Crossley, has aptly stated: "The relationship with pure science cannot, however, be strengthened by a policy of the purely, 'take and be thankful' type; something must be given in return; and it is hoped that science will be enriched by the publication of the pure scientific research carried out in the Shirley Institute."

The work thus far undertaken has naturally centered quite largely about India. This country, with an annual yield of over 4,000,000 bales on a little more than 22,000,000 acres, is second in cotton production only to the United States and possesses distinctive advantages and handicaps. Cotton is picked every month of the year in some parts of India, but the acre yields are low and numerous pests, including the pink bollworm take a heavy toll. The major portion of the Indian crop is of very short staple and does not compete with the best American or Egyptian growth in the cotton mills of either Europe or the United States.

In 1917 the Indian Cotton Committee was appointed by the Governor-General of India to examine into the agricultural and economic phases

of long staple cotton production in India. In its comprehensive report this committee recommended the establishment of a central cotton trade association in Bombay and the formation of a central cotton committee to co-ordinate all work with cotton throughout India. The Indian Central Cotton Committee was constituted by resolution of the Government of India in 1921 and continued as an advisory committee for about two years. It was then incorporated under the Indian Cotton Cess Act of 1923 as a permanent body with a definite constitution, funds of its own derived from a levy on the crop, and authority to undertake specific work for the improvement of cotton growing. The personnel provided for includes the agricultural adviser to the Government of India, the Director-General of Commercial Intelligence and representatives of Chambers of Commerce, Mill Owners' Associations, the Empire Cotton-Growing Corporation, cotton growers, Co-operatives, the Indian States, and the Cotton manufacturing and ginning industry. Provincial and local cotton committees have been formed in most of the provinces.

Aside from its more formal activities, the committee is a central body charged with the promotion of all measures which will aid the improvement of the Indian Cotton growing industry. Its representative character not only qualifies it to advise the central and provincial governments in matters concerning the industry but also affords a common meeting ground for all sections of the trade with the agricultural departments, which enables difficulties to be discussed and joint action taken for the common good.

During the year ended August 31, 1923, the Committee considered the regulation of transportation of cotton and of gins and presses, open cotton markets, cleaner packing, marketing arrangements with the East India Cotton Association, mixing of Punjab-American cotton and precautions against introduction of the boll weevil and other pests. Grants have been made for research in Bombay on the physiology of the cotton plant, especially boll shedding, studies on wilt and the spotted bollworm, and improvement of varieties ; in Madras for plant breeding work on herbaceous cottons and bio-chemical investigations to determine causes for variations in yields and resistance and susceptibility of the strains to pests and diseases ; in the Punjab for investigations of the isolation of pure types and a general physiological study of the growing of American cotton under canal irrigation, especially regarding water requirements and the causes of losses by shedding of buds, flowers, and bolls ; in the Central Provinces for breeding for better staple ; and in the United Provinces for studies on the control of pink bollworm.

A central agricultural research institute has been proposed by the committee to be supported by annual subsidies from the Central Indian States and the site to be given by Indore, with the Committee providing for a capital grant and annual expenses. Indore is considered an excellent situation for investigations of a group of problems connected with cotton growing, being in what is practically the only large homogeneous cotton tract in India. A technological laboratory near the Victoria Jubilee Technical Institute at Bombay is contemplated to provide for accurate spinning trials on new cottons for agricultural departments. A study of the intrinsic spinning characters of Indian Cotton and their correlation with measurable physical characters is regarded as an essential compliment to the plant breeding work now carried on by the departments and as a basis for the reform of trade classification of cotton and an improved marketing system.

This survey, while obviously incomplete, indicates the serious attention which is being given the cotton situation in the British Empire. Taken collectively, the efforts under way probably constitute one of the largest organized enterprises centered about a single commodity thus far attempted. It is therefore fortunate that the necessity of research as the foundation of the elaborate program in contemplation is so clearly and so generally recognized. The steady progress which is being made in co-ordinating and correlating the wide range of interests concerned is also quite significant and these conditions collectively augur well for an ultimately successful outcome.

## FIBRE FROM COCONUT HUSK.

The Journal of the Indian Institute of Science Vol. VII, Part iii contains an interesting paper by G. J. Fowler and F. Marsden on the retting of coconut husk for the production of coir used in making coconut matting. The fibre is obtained by soaking in water (which is changed from time to time for about ten months) the crude mass of fibrous tissue that forms the husk of the coconut fruit. The natives in India who carry on this part of the industry, have a good deal of indefinite and sometimes contradictory information as to the influence of various factors, such as the degree of ripeness of the fruit, the use of much or little water, the character of the water, and especially its salinity. Messrs. Fowler and Marsden find that the essential feature of the soaking process is the breaking down by bacterial agency of the material, described as insoluble gum or possibly a hemicellulose, which binds together the fibre in the husk. The necessary bacteria occur in the husk itself. They remain active so long as the water is changed frequently enough to prevent their being poisoned by the products of the reactions they cause. Discoloration of the coir, which sometimes occurs, is due to changes in the tannin originally present in the husk. This tannin, under unsatisfactory conditions of soaking, may oxidize to red insoluble products, which are deposited on the fibre. If ferruginous water be used for soaking, iron tannate may result, so as to give rise to blue coloured fibre. ("*Nature*," August 30, 1924 p. 326.)

## TROPICAL WORLD.

*MAURITIUS.*

A report on the College of Agriculture for the year 1923 has been submitted by the Director of Agriculture who is also the Principal. This College is a direct development of the School of Agriculture formerly attached to the Department of Agriculture. The first students were admitted in September, 1923, and the commencement of January following there was a total of 39 students on the College books. The courses of instruction fall under two heads (*a*) two year courses of instruction for the certificate (*b*) three year courses of instruction for the Diploma. These courses are specially designed for a career in the Sugar industry of Mauritius. The practical aspect of the training is maintained well in view and the students are required to work practically in the fields and workshops and to acquire manual dexterity. It would appear from the Report and the details referring to the equipment and methods of teaching, that this Institution should be of great service to the Agricultural interests of the island of Mauritius.

*HAWAII.*

The report of the Hawaiian Agricultural Experiment Station for 1922 which has recently been issued gives an account of various lines of agricultural investigations in those islands. In view of the interest which has recently been taken in the papaw fruit, it is not out of place to refer to the remarks on the investigations with this fruit. It has been found that fruits of very high quality can be produced by direct cross-pollination, and it has also been found that grafting methods were not satisfactory to any extent in the production of standard fruit, but that lateral branches planted as cuttings produce fruit equal to that of the parent tree in quality. By removing the tip from trees which bear their fruit too high for convenient picking, lateral buds are caused to sprout along the trunk of the tree. These laterals, when from one and a half to two feet in length, can be removed and set eight or ten inches deep in coarse gravelly soil. If this is carefully done they will soon root and develop as new trees producing fruit of excellent quality.

*UGANDA.*

The following items are extracted from the address of the Governor of Uganda at the meeting of the Legislative Council on May 28, last. It was stated that the cotton crop has been the best on record while coffee and rubber prices have been good, and the generally favourable season has afforded a great impetus to trade. The outstanding feature of Uganda is the success of the cotton industry. Last season's crop yielded just under 93,000 bales of lint of 400 lb. On April 30 of this year the figures stood at 123,000 bales with an estimate of a total for the season of 125,000; an advance of nearly 35 per cent. The value of this crop to the native cultivators of the country was between two and a half and three millions sterling. In connection with the development of the cotton industry it was stated that the Empire Cotton-Growing Corporation had at present three hundred ploughs for demonstration purposes in new districts and that these ploughs were in great demand by the natives. The development of the cotton industry places obligations on the Government for the development of transportation facilities and storage accommodation at the railway terminals. The Government was making every effort to keep pace with the demand on its resources in this respect. The labour position appeared not to be ideal. In some districts coffee planters and ginners were experiencing difficulties in securing the labour they required. In other districts it appeared that the labour supply was coming forward in increasing numbers. The development of a sugar factory with a capacity of twenty-four tons a day of refined white sugar was referred to as a very important new development. The plant would represent a cost of nearly £150,000 and about 15,000 acres of canes had already been planted. Some ten acres of sugar-cane per day would be required for factory consumption.

*ECUADOR.*

The cultivation of cotton in this country is on the increase, the greater part of the raw material employed in the flourishing textile industry being native grown. A small proportion of the crop is also exported and there is no reason why, with the advantages the country offers for the cultivation of this crop, this amount should not be increased. Varieties of cotton seed have been sent from the United States of America for experimental purposes. These are first being used in the regions most suitable for the growth of cotton and most likely to give a beneficial return though a small proportion is being kept for experiments in other parts of the country. The work is being carried out by experienced men under the auspices of the Department of Agriculture which will publish the results obtained for the benefit of interested people who can also obtain supplies of cotton seed on application.

*ZULULAND.*

In the "South African" of August 13, an article appeared under the heading "Potentialities of Zululand." This article refers to the agricultural development which is possible in Zululand particularly with reference to cotton production. This is likely to be of great importance in view of the demand for greater supplies within

the Empire and from the fact that a great deal of available land in this Protectorate is very fertile and probably well suited to cotton growing. More than 200,000 acres of such fertile soil were surveyed last year and have now been thrown open for allotment and it is the intention of the Government to build a railway line from M'Tuba-M'Tuba station to the Pongola River in order to open up the cotton belt. It would seem that there has been a proposition, however, to attempt to develop this project by settling the land with poor whites from the Transvaal and the object of the article referred to is to deprecate any such movement and to point out the futility of such an attempt. The climate is a very unhealthy one, for malaria is very prevalent throughout the summer months and if it were not for the presence of the anopheles mosquito and malaria this country would probably have been fully developed before this. As it is there is every prospect of successful development if settlements are made by people who have the necessary knowledge of preventive measures and who have the capital and the intelligence to carry out such measures and to so order their lives as to escape the ravages of malaria. Instances are not wanting in many parts of the tropical world of successful settlement and colonization of districts which were formerly veritable death traps. Proper conditions of sanitation, mosquito-proofing of houses and precautions against being bitten by mosquitoes out of doors at night have resulted in whites being able to live in comparative healthiness even in districts where the conditions did not allow for the elimination of the mosquito. It is pointed out that any attempt to colonize these new lands with any but the right sort of people would inevitably result in failure and a failure which would not only be disastrous to the individuals concerned but would also be a set back to the development of the country which would take many years to overcome. In another place in this issue of the Journal reference is made to the ability of the white man to live comfortably in the tropics provided he will take the necessary precautions, precautions which are well known and understood by all who have had to do with tropical life and development in the last few years.

*ASSAM.*

From the Annual Report of the Department of Agriculture for 1923-24 we learn something of the conditions of Agriculture in this country. Rice is the staple product as is amply illustrated by the fact that of the 5,897,793 acres under cultivation 4,624,064 were under rice. There are four experiment stations and one of them, the Titabar farm, is entirely devoted to rice experiments, selection, cross-breeding, &c. With regard to sugar-cane, the season was very unfavourable, the heavy storms towards the end of April interfering with the growth of young ratoon canes. The percentage of cane sugar in juice and purity co-efficient were slightly lower than those of last year due to the heavy rains that fell in September and October. Experiments with direct application of phosphates to sugar-cane have been continued for several years and the results show that this does not pay. The experiment will be dropped after the present year. Plots that were green manured last year gave increased returns and this experiment will be continued. There are three seed depots at Jorhat, Gauhati and Sylhet. There was a slight decrease in the sales of the two latter depots due to the fact that private enterprise is springing up and planters are now producing and selecting their own seeds. Cattle breeding is carried out only on one farm, the Upper Shillong, and attempts at breeding up a herd of pure Patna cows and improving the herd by careful breeding and the elimination of inferior animals are now producing definite results. But nothing much has yet been done along this line. At the cattle conference held in Bangalore it was recommended that an expert enquiry should precede the formation of a cattle improvement policy in Assam. A preliminary survey by an officer of the Provincial Agricultural Service will be carried out prior to an enquiry by an expert deputed by the Government of India. It is very necessary that action should be taken with regard to the improvement of the herd as statistics show clearly that a large number of unprofitable animals are being maintained in the country at considerable economic loss.

*JAMAICA.*

The wide spread of Mosaic disease in this island has driven planters to substitute the Uba cane for the many varieties of Creole cane grown. Great anxiety was experienced as to whether the small mills could deal with this variety which has a very hard skin. A test was made with the ordinary three-roller Chattanooga mill, so commonly used throughout Jamaica for the manufacture of sugar for local use, and it was found that this type of mill can crush the Uba cane effectively. It was also proved that there would be no appreciable extra strain on the mule or steer turning the mill. There remains, however, the question of wear and tear which time and experience alone can solve. However, the *Journal of the Jamaica Agricultural Society*, from which these facts are taken, advocates the keeping up of creole canes, by constant rogueing and watching for resistant varieties, since if Uba cane was the only variety grown, Jamaica could not hope to continue successfully in the sugar business. In connection with Mosaic, the Director of Agriculture has arranged for some desirable canes from Porto Rico to be sent to Kew, where they will be treated for disease before being sent out to Jamaica. It is feared that unless adequate precaution is taken in importing sugar canes into Jamaica new diseases may be imported.

## POSITION OF FIBRE PRODUCTION.

[*The following article is the conclusion of Dr. E. Goulding's paper read at the Brussels Conference last April. The first portion appeared in "Tropical Agriculture" for September, and the second portion in the issue for October.*]

*Jamaica.*—Sisal hemp plants were introduced into Jamaica from the Caicos Islands in 1886 and planted at Hope on an area of 30 acres. This attempt, however, resulted in failure as the plants poled when they were about two years old and died before the leaves were ready to be cut. In 1891 plants were procured from Florida and were cultivated in Vere, but, owing to a decline in the market price of the fibre, the enterprise was abandoned. Later efforts have proved that the crop will grow well in Vere when planted on limestone soils.

The henequen plant (*Agave fourcroydes*) was introduced into Jamaica from Yucatan about seventy years ago and plants have been growing freely in several districts. Observations made on plants growing in the Botanical Gardens showed that this crop can be cultivated with success on dry alluvial soils.

Experiments carried out more recently at Lititz (Southern St. Elizabeth) and at Hope (near Kingston) have confirmed the above results as regards the types of soil best suited to the Sisal and henequen plants. By March, 1919, the Department of Agriculture had planted 500 acres at Lititz on land which was regarded as useless for other crops.

Samples of Sisal hemp and henequen fibre produced at both Lititz and Hope were examined at the Imperial Institute in 1919 and found to be of promising quality.

In 1921 it was reported that 4,000 acres had been planted in Jamaica with Sisal hemp, 3,000 of which were situated in the neighbourhood of May Pen, in the parish of Clarendon, where two factories had been erected. A private factory was also stated to be at work at Hodges Pen in St. Elizabeth. Some hundreds of acres were nearly ready for cutting on the Government Plantation at Lititz and a factory had been established at the northern extremity of the plantation, so that the adjacent lands which are in private possession might be planted with Sisal hemp and the leaves sold to the factory on a co-operative basis.

There are about 1,000 acres of land within two miles of the factory which are well adapted to the crop, and, in 1921, 200 acres of this had already been planted by one of the land-owners.

The Lititz authorities offered to advance £2 per acre for approved plantations to be established within three miles of the factory.

In 1922 there were 1,141 acres devoted to the crop at Lititz. The factory, which is equipped with English machinery, commenced operations in that year and 50 tons of the fibre produced was sold at market price then ruling for the highest quality. There is, therefore, no doubt that the savannah lands of Lititz are capable of yielding excellent fibre. The new industry has been of great advantage to the people of Lititz, many of whom would otherwise have suffered severe privations during periods of drought.

Fibre was also manufactured in 1922 at three factories in Clarendon, and a Sisal rope-making factory was started by private enterprise at May Pen.

*Caicos Islands.*—The Sisal hemp plant was introduced into the Caicos Islands from the Bahamas about the middle of the nineteenth century, but it was not seriously cultivated until 1890. Two companies were formed in that year which established plantations in West Caicos, and at Breezy Point, East Caicos. Several private plantations were already in existence and a small shipment of fibre from one of these to New York realised a price equal to that of the best Yucatan fibre. Subsequently the two companies extended their operations and introduced machinery for preparing the fibre. The industry proved of great value to the Colony by giving employment to the people and thus affording them much assistance when other crops failed owing to drought.

During the years 1899-1906 the value of the annual exports of Sisal hemp ranged between £5,000 and £7,500. In 1906 the areas devoted to the crop were as follows: East Caicos, 2,000 acres; West Caicos, 1,000 acres; Bellevue, North Caicos, 150 acres; Haulover, Grand Caicos, 50 acres; total 3,200 acres. Subsequently great fluctuations occurred in the quantities of fibre annually exported owing to several causes, including the hurricane of 1908 and variations in the market price of the product. In 1912 the West Caicos Company went into liquidation, and in 1918 the East Caicos Company decided to cease operations and no effort was made to replant or to open up new areas. In 1920 the industry was abandoned.

Various reasons are given for the failure of this industry, which for some years showed such great promise and is so well suited to the climatic conditions of the islands. It is considered, however, that the chief cause was connected with transport difficulties, and the opinion has been expressed that until some means can be found to make direct shipments to the United Kingdom, instead of through New York, neither Sisal hemp nor any other industry can be successfully developed.

*Antigua.*—Attention has been directed to the question of the cultivation of Sisal hemp on a commercial scale in this island, and in recent years steps have been taken to establish plantations. It was anticipated that extensive areas would eventually be devoted to the crop.

*British Guiana.*—Sisal hemp grows well on the coastal lands of British Guiana and there are many places suited for the development of the cultivation.

The first important trial of Sisal hemp in the Colony was carried out at Cole's Glen on the Demerara-Essequibo Railway. The plants grew very well at first, but later the plantation unfortunately had to be abandoned owing to a severe

outbreak of the leaf disease, *Colletotrichum Agaves*, which caused the destruction of nearly all the plants.

Subsequently over 250 acres were planted with the crop on an estate situated on the Mazaruni River, and a factory was erected and equipped with machinery for fibre extraction. Excellent fibre was obtained, but, owing to the high cost of production, due to labour conditions, the enterprise was not a financial success. This plantation also became attacked by the leaf disease, and the industry was abandoned.

*British Honduras.*—Attempts have been made to grow Sisal hemp at the Botanic Station, British Honduras, and a sample of fibre prepared from plants grown at this station and forwarded to the Imperial Institute was of excellent quality and regarded by experts as equal to prime British East Africa fibre.

Experiments with Sisal hemp have been carried out in many parts of Australasia, and there is no doubt that there are large areas in Northern Queensland, the Central Province of Papua, the Northern Territory and the north of Western Australia which are well adapted to the crop.

*Queensland.*—In 1904 special attention was directed to Sisal hemp cultivation in Queensland and a few acres were planted by the Department of Agriculture at the penal establishment at St. Helena with a view to the production of planting material. Between 1904 and 1910 hundreds of thousands of suckers and bulbils were distributed to intending growers in many parts of Queensland, Papua, Fiji, the Solomon Islands and other countries.

At one time there were prospects of the establishment of a large Sisal industry in Queensland, but the high wages now required for labour and the increased cost of machinery have rendered it impossible for the fibre to be profitably grown and the cultivation is therefore no longer recommended by the agricultural authorities.

Mr. T. H. Wells, who has produced Sisal hemp with considerable success on his estate at Farnbro, Childers, in Queensland, has made some interesting suggestions for the cultivation of the fibre in Australia by communal planting (*United Empire*, 1917, vol. viii, p. 551). He proposes that co-operative settlements should be formed in which each planter should contract to supply the leaves produced on 30 acres to a central mill in which the fibre would be extracted and prepared for the market.

*Northern Territory.*—The Sisal hemp agave was first introduced into the Northern Territory in 1891. During the years 1907-9 the Government endeavoured to create a fibre-growing industry. Considerable interest was aroused and a large number of plants were distributed, but the interest soon disappeared and only a small proportion of the plants was ever planted out of the nursery beds. Excellent fibre was produced from plants growing in the Botanic Gardens at Palmerston and there is no doubt that the country is well suited to the crop.

During 1912 another attempt was made; about 5,000 plants were distributed and a small bounty was offered for a few years in order to establish the industry. This attempt also failed owing chiefly to the high cost of labour in the Territory.

*Papua.*—In the Territory of Papua, New Guinea, *Agave sisalana* has been grown with excellent results. The region which appears best adapted to the industry is the "dry belt" district of Port Moresby, a narrow strip of limestone country about 100 miles long, which extends along the south coast from Hall Sound to Hula and has an annual rainfall of from 27 to 42 in. Planting commenced in this district about the year 1907, and in 1909 the area under the crop amounted to 382 acres and had increased by 1910 to 1,131 acres. The first recorded exports were made in 1910-11 and were of value £340. In 1913-14, 3,110 acres were devoted to the crop and 142 tons of fibre, of value £3,633, were shipped. The exports of Sisal hemp from Papua during the years 1917-18 to 1921-22 were as follows:

| *Year.* | *Quantity tons.* | *Value.* |
|---|---|---|
| 1917-18 | 343 | £ 17,682 |
| 1918-19 | 287 | 12,352 |
| 1919-20 | 336 | 12,284 |
| 1920-21 | 188 | 7,723 |
| 1921-22 | 145 | 4,630 |

It will be seen from these figures that, although a promising industry was established, the success of the enterprise has not been maintained. In 1920-21 it was reported that there were only three important Sisal plantations in the Territory, of total area 5,857 acres, and that these were not being developed with any enthusiasm. In the following year it was stated that the industry was no longer profitable owing to the low prices ruling for the fibre and the high cost of transport, and that the plantations had a very neglected appearance. Very little fibre was being produced, and the exports had therefore declined.

*Solomon Islands.*—Experiments have been made to determine the possibilities afforded by the Solomon Islands for Sisal hemp production, but the results have led to the conclusion that the climate is too damp for the crop to be grown successfully.

*Fiji.*—Experiments in Sisal hemp growing were commenced in Fiji in 1906 and favourable results were obtained by the Department of Agriculture at the Nasinú and Lautoka Experiment Stations, situated respectively in the wet and dry regions of the island of Vitilevu; but the dry zone was found to be best adapted to the crop.

There is much land in the Colony available for Sisal hemp which is unsuited to the cultivation of other products, and in 1912 a considerable area was leased to planters for its cultivation. It was anticipated that the production of the fibre would become an important industry, but the crop has never assumed any great dimensions, and in 1923 it was reported that on only one plantation was it

being grown on a large scale. The following exports have been recorded: 1912, 8 tons; 1913, 8½ tons; 1914, 15 tons; 1916, 5½ tons; 1917, 17 tons; 1918, 4 tons; 1919, 6½ tons; 1922, 8 tons.

The yield and quality of the fibre are quite satisfactory, and the industry would be capable of considerable expansion if the labour shortage could be permanently overcome.

## BANANAS RESISTANT TO WILT (PANAMA DISEASE).

Wilt has been a recognized disease of the banana in the West Indian Region for over twenty years. The Gros Michel or Martinique variety, the only kind grown on a great scale for export to northern markets, proved to be highly susceptible to this disease which has occasioned heavy losses in Central America, and is regarded as the main factor limiting or preventing the cultivation for export of that variety in some of the West Indian Islands. Wilt is due to the invasion of the vascular system by a fungus, a species of fusarium, which penetrates into the plant from the soil by way of the roots or through wounds in the rootstock; its growth in the vessels results, by interfering with the movement of water from root to leaf and by toxic action, in a stunting of growth, wilt and collapse of the foliage and death of the sucker or tree. The vasculars of rootstock and trunk become characteristically coloured yellow, orange, dull crimson or reddish brown, an internal symptom which renders the detection of the disease easy. Wilt is spread by planting infected suckers, mulching with infected banana trash, and by infected soil (hence by flood water and to some extent no doubt by soil carried away on feet and implements).

Recent observations in Jamaica indicate that land thrown out of banana cultivation for twelve years on account of disease retains the infection and therefore communicates the wilt to a susceptible variety if planted again, so that land which has carried diseased Gros Michel plants is for an indefinite period unfit for the growth of that variety. There are many thousands of acres of such land in Central America, much of it in Surinam and Cuba and a small but steadily increasing amount in Jamaica. In some other parts of the West Indies, such as Trinidad, where the disease has been present for many years, planters are unwilling to take up the cultivation of Gros Michel although new plantation industries are badly needed and there are considerable areas which in regard to soil and rainfall seem well fitted for banana cultivation. The fruit has retained its hold on the great consuming centres of the north so that it is one of the few tropical and sub-tropical products which is not 'depressed.' The market being favourable, the substitution of Gros Michel by a variety or varieties highly resistant to wilt and capable of meeting the rather exacting conditions of shipment in bulk and wastage at the distribution end, would be welcomed in a number of territories where the cultivation of Gros Michel is ruled out on available land known to be infected or supposed to be infected.

Some fifteen years ago an attempt was made to save the industry in Surinam and restore production in large areas in Central America by substituting the highly resistant variety 'Congo' discovered in one of the French islands. Unfortunately the form of the bunch and the weakness of the fruiting stem resulted in such heavy wastage that the variety was abandoned. For similar reasons the planting for export of the highly resistant Chinese (dwarf or Canary) banana in the West Indian Region has not found favour with the shipping interests. These failures gave rise to the impression that no variety capable of replacing Gros Michel existed in the West Indies and attention was directed to the East especially to the Philippines where a comprehensive collection of varieties was being formed by the Department of Agriculture. It was apparently one of these kinds which found its way some ten years ago *via* Washington to Surinam under the name Bumulan. This variety has not contracted wilt in Surinam and its fruit characters give promise that it may prove valuable. Suckers of this variety have been very willingly forwarded to the College by the Director of Agriculture in Surinam and will be released shortly from quarantine. A year ago attention was directed to a banana in Grenada known locally as 'Giant Fig'; it resembled Gros Michel in habit, form of the bunch and size of the fruit which, however, was rounded at the end. It seemed so promising that suckers were procured and its resistance to wilt investigated. Thirteen suckers were planted early in November, 1923, in holes heavily infected with mixed pure cultures of the disease-producing fusarium taken from several susceptible varieties; at the same time eleven suckers of Gros Michel from Grenada, where wilt is not known to occur, were planted in adjacent holes similarly infected. Nine of the Gros Michel plants which were very backward in growth developed characteristic external and internal symptoms of wilt in one or two months while the other two remained stunted. The thirteen Giant Fig plants grew normally, one flowered in July the rest in August, and all are now fruiting and showing no signs of disease. It is evident that this variety is proving highly resistant to wilt. The same variety under the local name of Bout. Rong (Round-end) is cultivated by the peasantry in St. Lucia and it is doubtless present in Dominica and other islands. Later in 1923 the Director of Agriculture in Jamaica reported the discovery there of a banana closely resembling Gros Michel which was proving highly resistant to wilt. It appears to have been smuggled into the island, ten years ago, by a labourer returning from the plantations in Guatemala; the fruit has been accepted for export but careful trials of its shipping qualities are contemplated in 1925.

The Director has named the variety Robusta. The fruit characters, as yet imperfectly described, suggest that Bumulan, Giant Fig (Bout Rong) and Robusta may be the same variety introduced from the East at a wide interval of time.

Planters who are interested in the prospects of a banana industry in Trinidad and other islands of the Lesser Antilles are welcome to inspect the Giant Fig and other varieties now fruiting at the College. In St. Lucia a British Company acquired land in 1923 established a nursery and active planting in the Roseau valley was begun in July of the present year. Material is available for planting up close upon 1,000 acres in Gros Michel. Wilt is present in St. Lucia but as careful attention is being given to the selection of suckers it is hoped that the planting material may be free or nearly free from disease. In Grenada, where wilt has not been observed, Gros Michel is being propagated in the expectation that shipping facilities will be available. It is evident, however, that the co-operation of a number of neighbouring producing territories will be necessary in order to place on a secure basis a regular service of shipment on a commercial scale to Europe and North America.

S. F. A.

## COLONIAL RESEARCH COMMITTEE.

The report of this Committee for 1923 gives an account of the work done under the headings of the various colonies concerned. Attention is drawn to the conclusion of the geological investigations in the Leeward and Windward Islands, B.W.I., to the interesting and important researches into the Panama disease of bananas, which are being conducted with the assistance of the committee at the Imperial College of Tropical Agriculture in Trinidad; and to the re-discovery in British Honduras of deposits of tin which appear to have been known to the Spaniards but have long been lost sight of. In Nyasaland the superficial examination of the Sumbu coalfield has been continued with encouraging results and it would appear that coal suitable at least for local use exists there in some quantities. It is considered as possible also that coal of quality suitable for export will be found. A steam trial of the local coal has been conducted with a large McLaren tractor used for ploughing cotton lands, and was entirely successful. The area of this coalfield is estimated at 150 square miles. The investigation of sponges in the Bahamas was continued throughout the year. It has developed so that the rate of growth in some localities is much more rapid than in others and it is clear that the selection of a locality in which the rate of growth is high would be of great importance to any commercial cultivation of sponge. The breeding seasons have been ascertained with fair accuracy for all the six chief types known to the sponge market, but more extended observation is necessary to determine accurately the breeding period of each kind. The larvae of the various type are easily distinguished from one another and show that the six types referred to are clearly separable as distinct species. The investigation of the breeding of sponges has an important bearing upon the regulation of the sponge industry. It will probably be found that measures of protection should take the form of a close time covering a breeding season and in this connection it is essential to know as nearly as possible the limits of the breeding seasons of the separate species and the limit of these periods in different localities.

The Committee have taken no further active part in Forestry matters in this Colony, but it may be interesting to record that their former enterprise has led to considerable further developments. The appointment of Mr. Hummel, as Conservator of Forests, was recorded in last year's report, and he has now been provided with a Deputy Conservator and two Assistant Conservators, who are all fully trained foresters. The provision of $250,000 for forestry purposes by loan has been secured by legislation, and an Ordinance has been passed to provide for the establishment of a Forest Trust on the lines recommended by the Committee. The Trust consists of three official and two unofficial members and its object is the administration and control of the forestry department and the development and maintenance of the Crown forests of the Colony. It is also proposed that a percentage of the revenue from forest products, beginning at twenty per cent., and rising to sixty per cent. should be appropriated towards the expenses of the forestry department. The annual amount of the forest revenue is at present approximately $60,000.

## SUGAR-CANE EXPERIMENTS AT STE. MADELEINE, TRINIDAD.

The above sugar company has recently issued its first report (limited circulation) on sugar-cane experiments carried out on the company's estates during the season 1923-1924. The field work has been organized and conducted by Mr. G. A. Jones, Agronomist in charge, while the chemical analyses of the juices have been made by Mr. Scott, the factory chemist.

The report falls into two parts: I.—Experiments with varieties of sugar-cane; II.—Manurial experiments with sugar-cane.

The variety experiments were conducted on five estates where the rainfall for the growing season varied from 42·84 inches to 57·34 inches and where some five different types of soil exist: black, brown, red, alluvial (recent and old) and sandy. The plots varied from $\frac{1}{10}$ to $\frac{1}{4}$ acre in size and farmyard manure was applied in every case at the rate of 20 tons per acre. All the

plots, with one exception, were planted in September and reaped in March, April and May. Results are reported from ten varieties as plant canes—B. H. 10 (12), A. R./N. 26, Uba, Ba. 6032, B. 156, B. 6308, B. 347, B. 4934, B. 1753, B. 6388. Thirteen others, principally newer Trinidad and Barbados seedlings have been included in next season's trials. The variety B.H. 10 (12) heads the list on all soils in point of sucrose yield per acre. Its cane yield per acre while uniformly good, averaging 35·87 tons from all plots, was excelled on occasions by B. 156 Ba. 6032, Uba B. 347 and A.R./N 26; the last named (a seedling raised in Trinidad by a Mr. Robertson) which came next to B.H. 10 (12) in the final averages actually gave 2½ tons of cane per acre more, but was superseded by the former by approximately ¾ tons sucrose per acre. The third place is taken by Uba; here again the field return was slightly better than B.H.10 (12), but per cent. sucrose in cane was 13·93 compared with 17·18 for the latter. Nevertheless, Uba proved itself a most useful cane for poor lands such as the sour red clays of the district, and its cultivation is being extended. B.156 and Ba. 6032 follow in the order mentioned. B. 156 it may be noted has been the standard cane for many years and the report states that had all the plots been reaped in March or April, this cane would have shown up considerably better, as its sugar contents fell off later in the crop. Only one series of first ratoons was reaped, consisting of two plots each of seven varieties. D. 625 occupies first place, with B. 156 second and B.H. 10 (12) third. Next year's trials should give a better idea of the ratooning qualities of the last mentioned seedling under Ste. Madeleine conditions.

Coming now to Part II of the report—manurial experiments—three main objects were in view :—

A. I.—To determine the most economical dressing of nitrogen to apply to seedling canes on black soils.

II.—To determine the relative value of nitrogen as sulphate of ammonia and nitrate of soda.

B.—To determine the most economical dressing of nitrogen to apply to Uba canes growing on red soils.

C. I.—To determine what advantage (if any) is derived by applications of lime to red clay soils and to stiff alluvial soils.

II.—To determine the relative value of burnt lime and ground limestone as a dressing on these soils.

Dealing first with A, applications varied from 40 lb. N. to 60 lb. N. per acre. The plots were $\frac{1}{10}$ acre in size and arranged in duplicate with two 'no manure' controls. Applications up to 60 lb. N. were made all in May; in the case of plots receiving 60 lb. N. per acre, one-half was applied in May and one-half in September. Although inconclusive on account of lack of sufficient replication of plots, the season's work seems to indicate that there is little to choose between sulphate of ammonia and nitrate of soda as sources of nitrogen and that the most remunerative application of nitrogen is 40 lb. per acre. The work under B. was arranged on sounder methods of experimentation so that the results can be studied statistically to advantage. There were ten series of experiments involving 100 plots of $\frac{1}{30}$ acre each, each plot being repeated ten times. No. 1 received no manure, No. 2 twenty tons pen manure per acre, the remainder varying amounts of nitrogen as sulphate of ammonia, from 40 lb. to 100 lb. per acre. The 80 lb. and 100 lb. applications were given in two equal doses, half in July and half in September. Summarizing the results obtained, indications are that 40 lb. N. produced an increased return over no manure of 5·2 tons per acre which is statistically significant; that with Uba cane 60 lb. N. is better than 40 lb. Larger applications gave results significantly no better than 60 lb. Twenty tons pen manure per acre gave significant increased yields of 4·2 tons per acre, in other words less than 40 lb. N. per acre. It is only fair to state that the pen manure was applied too late after planting for its influence to be felt to the full. Similar experiments were conducted with Uba ratoons, but severe attacks of froghopper prevented definite conclusions being drawn.

Lastly, the results with lime (CI and II) will now be considered. It was found in the first place that 2 tons of ground limestone per acre on red clays where nitrogen is also used gave an increase after one year which is significant, compared with no significant increase from 1 ton burnt lime similarly used. Secondly, on alluvial soils as the result of two years' trials, plots receiving ground limestone at the rate of 2 tons per acre gave substantially greater profits than those receiving one ton burnt lime or 4 tons ground limestone, while applications of 2 tons burnt lime resulted in most cases in a monetary loss. The only fertilizer treatment these plots received was 20 tons pen manure per acre. On the whole, the increased yield of cane on all plots receiving lime was in the ratio of 100 (burnt lime) to 178 (ground limestone).

In conclusion, it would appear that these experiments are being conducted on useful lines, and while too much reliance cannot be placed on one or two season's work—seeing that careful replication of plots with sufficient number of controls and rainfall conditions have an important bearing on results, notably from manurial trials—the Usine Ste. Madeleine and those in charge of the experiments are to be highly commended on the promising start that has been made to solve their field problems.

J. S. D.

## COLLEGE COURSE OF SUGAR TECHNOLOGY

With reference to Professor Boyd's article which was published under the above heading in "Tropical Agriculture" for September, it should be mentioned that the machinery, plant and apparatus were presented almost in their entirety by Sugar Machinery Manufacturing and allied firms in Great Britain, to whom the Governing Body is greatly indebted for the assistance which they have given. The "appropriation" mentioned in the article was made by the Governing Body from the College Building funds and was for erecting the building in which the machinery and plant are now being installed.

## COLLEGE NEWS.

During the Conference of the West Indian Associated Chamber of Commerce recently held in Port-of-Spain, the delegates visited the College and were shown over the sugar factory and the College buildings. The representatives were:—Trinidad, The Hon. George F. Huggins, O.B.E., F. G. Grant, Esq.; British Guiana, The Hon. A.P. Sherlock and W. Speed, Esq.; Barbados, The Hon. H. B. G. Austin and Captain Wm. Bowring, O.B.E.; Grenada, John Barclay, Esq.; Antigua, The Hon. N. Scott Johnston.

The Principal returned from St. Vincent, where he had gone to pay an official visit on October 24 by the S.S. *Chaleur*.

The Principal left for Barbados on October 31, and is expected back on or about the 6th of November.

A number of Demerara Sugar Planters on their way through from leave in England visited the College and showed great interest in the Sugar Factory.

Mr. C. Y. Shephard, B.Sc. (Econ.), arrived in Trinidad on October 5, to take up his appointment as Reader of Economics. Mr. Shephard spent four years at the London School of Economics obtaining his degree (1st Class Honours) in Modern Economic History. Mr. Shephard has done special research work in connection with the Production and Marketing of Tropical Agricultural Staples.

The following six students have been sent out by the Empire Cotton Growing Corporation for a post-graduate course in connection with cotton:—

Mr. J. B. Hutchinson, B.A., educated at Ackworth School and Botham School, York, obtained an open exhibition at St. John's College, passed the Part I Natural Science Tripos, 2nd Class, and Part II Botany, 2nd Class at Cambridge, where he held a Junior Studentship under the Corporation and studied particularly research methods in Genetics.

Mr. J. E. Peat, B.Sc. (Edin.), who held a Junior Studentship under the Corporation at Cambridge, was educated at George Herriot's School, Edinburgh University and Cambridge and was *proxime accessit* for the Vans Dunlop Scholarship in Agriculture in 1923. Mr. Peat rowed for his College.

Mr. F. S. Parsons, B.S.A. (Guelph) educated at Woodstock College, Ontario Agricultural College, Guelph, and University of Toronto, where he took his degree, enlisted in 1914 and served in France, Africa and India. Mr. Parsons, who took a four-year course at Guelph received the Ontario Agricultural College Memorial Scholarship.

Mr. W. C. Lester-Smith, B.A. (Agric.), who intends to specialise in Mycology, was educated at Bloxam School and Pembroke College, Oxford, where he obtained his Diploma in Rural Economy and saw four years war service abroad. Mr. Lester-Smith was engaged in advanced work in Mycology and Rural Economy and taught temporarily at Eton during the illness of one of the Staff.

Mr. J. W. Cowland, B.A., Diploma (Hort.), who is taking up research in Entomology, was educated at Winchester and Queens' College, Cambridge. Mr. Cowland has been engaged in research on the apple bud weevil. For his degree his work included Physiology and Genetics while for his Diploma he took Entomology and Mycology.

Mr. H. Marsland, B.Sc. (Edin.), N.D.A., N.D.D., Lancashire Diploma, who is specially interested in Genetics and Plant Physiology, was educated at Ashton Secondary School, Harris Institute, Preston and Edinburgh University. While at Edinburgh Mr. Marsland acted as Demonstrator in Botany.

Mr. J. L. Illingworth, B.A., who is taking a post-graduate course in Mycology, was educated at Western College, Harrogate, and the Grammar School, Ilkley and took an Honours Degree in the Natural Sciences Tripos at Cambridge.

Mr. I. A. Sutherland, educated at Elstree Lodge, Bexhill and Lancing College was also under private tuition while he studied agriculture and did some practical agricultural work. Mr. Sutherland, who is taking a post-graduate course in cotton growing, also spent some time at the S. E. Agricultural College, Wye.

Mr. Miguel Aspiazu arrived in Trinidad on September 29, to take a special course in Agriculture. Mr. Aspiazu was educated at Columbus College, Guayaquil, Colegio Tomas Martinez; and Colegio Vicente Rocafuerte (Government High School) and obtained the degree of Bachelor of Philosophy.

The Diploma Students taking the First Year Course are: L. A. Blanc, J. A. Potter, A. C. Gonsalves, and H. C. Vilain, Trinidad; D. D. Haynes, British Guiana; J. A. McDonald, Antigua; A. C. G. Palmer, St. Lucia, and R. M. Steven, St. Vincent.

Students for the Second Year Course are: J. G. Davies, England; H. D. Huggins, Nevis; and H.B. Springer, Barbados.

Students for the Third Year Course are: S. C. Littlepage, B. G. Montserin, and V. I. Mulloon, Trinidad; S. H. Evelyn, A. H. McKinstry, D. R. D. Wiles, and C. H. B. Williams, Barbados; and P. D. R. Bovell, Jamaica.

## TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—On September 26 the balance available for export during the remainder of the year was 440,000 tons compared with 391,000 tons at this time last year. On October 9 the New York raw sugar market was reported to be steady at $6.03 for Cubans duty paid, except for December and January which advanced on covering and trade buying. The Cuban crop is returned at 4,052,000 tons.

COTTON.—Considerable unsteadiness was experienced in the Manchester cotton market during the beginning of October. On September 17, current month futures were 12·73*d.* but rose more than 2*d.* during the first week of October. Upland (Liverpool) was quoted at 14·09*d.* on October 10.

CACAO.—Cacao has continued to rise. On account of large orders for winter supplies the market has been healthier than it has been for months. Trinidad mid-red was quoted at 15¾ cents per lb. New York on October 17, and London 78*s.* to 80*s.* per cwt. Accras reached 35*s.* in London at the beginning of October and were being held for 51*s.* 3*d.*

COFFEE.—Coffee has taken an upward turn and is assisted by the rise in tea and cacao. London sales included Santos at 106*s.*, Rio at 104*s.*, Fine Costa Rica at 170*s.*, good middling at 160*s.*, Kenya at 160*s.* for very fine, Mysore middling at 140*s.* The arrivals of new crop coffee at the Brazilian port are much below those of last year.

TEA.—Tea remains perhaps the healthiest of present markets, the buoyancy of trade and the good sales being spot business based on a genuine increase of demand.

Averages at the beginning of October were:—Ceylon 23·26*d.* Indian 21·97*d.*, Java 18·9*d.*

SISAL.—The upward trend in Prime Sisal in London has continued and on October 1 had reached £49 per ton. Manila hemp made a rapid advance rising from £44 10*s.* on September 3 to £55 per ton on October 18.

RICE.—Rice has not shared in the advancing trend of other cereals and remains steady at 17*s.* for Burmese (London). The supply is adequate.

RUBBER.—Rubber improved appreciably during September rising from 14*d.* per lb. for Plantation Crepe on September 3, to 14¾*d.* per lb. on October 18 (London). Smoked ribbed sheet rubber makes 15*d.* for new year delivery. The market for Brazilian and Ecuador rubber is rather dull.

## AN EXPERIMENT WITH COIMBATORE IN INDIA.

In a recent issue of the *Agricultural Journal of India*, Wynne Syer, B.A., gives some very interesting results of a mill and field trial with the two canes Co. 232-Co. 233. The experiments were carried out at Pusa and both canes were planted in February under the usual planting conditions obtaining in that locality, and 600 pounds of castor cake per acre was used. The canes were harvested on December 18th and ground the next day. No irrigation was undertaken. Unfortunately, however, the canes passed through a severe spell of hot weather during their growing period and the rainfall during that time was only 26 inches, whereas an average rainfall for the same period in the same district is 45 inches.

The yield of Co. 232 was found to be about 360 maunds per acre and that of Co. 233 was 220 maunds per acre. This marked difference of course caused the abandonment of the further use of Co. 233 upon the grounds of being unfit. Both canes gave a very low sucrose upon milling and although Co. 232 was much higher than Co. 233, neither were very desirable from the factory standpoint. It was not possible to mill these canes until they had become overripe, and this will no doubt account for low mill results to a certain extent.

Co. 232 is a straight clean-growing cane, maturing early with a good sucrose content and it would be very interesting to see what results would follow should this type be handled under normal conditions, both in regard to rainfall and to milling at the proper time. Co. 232 and Co. 233 are both seedlings from the same parents P.O.J. 213 and Katha. Both canes are different in many respects from their parents. Co. 232 was planted in 1924 and will be harvested at the proper time of maturity and an effort will be made to determine exactly what its advantages over Co. 214 are with a view to replacing the latter by the former.

Co. 214 often shows signs of deterioration and twisting, whereas Co. 232 is a straight, tall, upright cane, early ripening and fairly hardy. The results of this year's field and mill trials will be awaited with a great deal of interest by those connected with the cane industry.

It is the aim and desire of white sugar manufacturers in India to obtain a hardy and early ripening cane suitable for white sugar manufacture, and it is hoped that Co. 232 will eventually answer this purpose.